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Changing image of correlation optics: introduction

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The Twelfth Bi-annual International Conference on Correlation Optics was held at Chernivtsi National University in western Ukraine, 14-18 September, 2015, despite unfavorable political circumstances and economic difficulties in Ukraine. Continuing a series initiated in 1993, participants from 21 countries contributed about 120 research presentations on traditional topics, such as information content of statistical optical fields, including polarization optics and coherence; optical correlation devices based on diffractive optical elements; optical correlation diagnostics, interferometry and microscopy of rough surfaces and random media; and new applications of correlation optics in biology and medicine [1–5]. Due to a reduction of contributions from researchers in Russia and Crimea, fewer participants attended compared to previous occasions. This conference was quite successful, however, and the result of two conferences, Correlation Optics and Singular Optics, merging following the cancellation of the conference on singular optics in 2014, traditionally held in Crimea. With a consensus among industry leaders, the two meetings have since been held jointly, with the establishment of Singular Optics as a “conference within the conference.” The conference format provided the opportunity to identify interesting trends in modern optics and photonics and illustrated the evolution of correlation optics, some of which are highlighted in this feature issue.

Evolution from investigation of optically manipulated micro and nanoparticles dependent on interrelation among the orbital and spin components of the angular momentum of a light beam to the use of the characteristics of such motion in metrology of optical constants, such as complex absorption coefficient, and studying the media parameters [6]. This trend focused on solutions to the classical inverse problem in optics, as well as at finding new functionalities for engineering of specific optical fields [7], and comprehensive understanding of the physics of evanescent waves and potential diagnostic applications through attracting deep quantum mechanical analogies for elucidation the interrelations of spin and orbital components of the angular momentum of optical beams [8,9].

2D Stokes-polarimetry finding its statistical electromagnetic substantiation within the theory of partial coherence [10] became a powerful tool for investigation of the intimate structural peculiarities of light fields [11], which are “depolarized on a large scale but are completely polarized on a small scale” [12]. Taking into account that most of the problems in singular optics lead to inhomogeneity in polarization complex light fields, one can conclude that modern singular optics shares more in common with correlation optics than coherent optics [11]. The set of sign principles related to C and L singularities, Poynting vector singularities and phase singularities of the

complex degree of polarization are among the highlights of emerging correlation singular optics. And, finally, the promise within applications of optical correlation approaches for biomedical optic emerges from a combination of 2D Stokes-polarimetry with auto fluorescence technique providing pre-clinical diagnostics of cancer at a molecular level [11].

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